PATENT SPECIFICATION

(11) 1314897

1314897

NO DRAWINGS

(21) Application No. 35980/70 (22) Filed 24 July 1970

(31) Convention Application No. 845 039 (32) Filed 25 July 1969 in

(33) United States of America (US)

(44) Complete Specification published 26 April 1973

(51) International Classification C11D 3/22

(52) Index at acceptance

C5D 6A5B 6A5D1 6A5D2 6A5E 6B10B 6B12B1 6B12E 6B12F1 6B12F4 6B12G2A 6B12G3 6B12L 6B12M 6B12N1 6B12N2 6C6 6C9

(All) Hydroxypropyl Methyl Cellulose — as a laundry aid

(54) LAUNDRY AIDS

(71) We, CELANESE CORPORATION of 522 Fifth Avenue, New York 36, State of New York, United States of America, a Company incorporated in accordance with the laws of the State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to laundry aids and more specifically to hydroxypropylmethyl cellulose laundry aids.

Wet-soil-redeposition has been recognized as a major source of soiling for a number of years. In simplified terms, this phenomenon is the spreading-out of localized soil over the entire area of a textile product being cleaned, or as sometimes happens, the transfer of soil from a heavily soiled product onto a lightly soiled product during cleaning. There are certain generally accepted theories as to how redeposition occurs during laundering.

When soiled articles are placed in a laundry machine with water and detergent, theoretically, the soil is removed from the fabrics and dispersed by the detergent. The degree of soil removal from the fabric is dependent upon many factors, including water temperature, type and amount of soil, type and amount of detergent, and the chemical composition of the textile fibers being laundered. If the detergent present in the wash water is not functioning with the proper degree of efficiency, all of the soil will not be held in dispersion. In practical terms, this results in what can be described as a three-way equilibrium between soil remaining on the surface of the fabric, soil dispersed by the detergent and soil which is mechanically suspended in the wash water by the agitation forces of the laundry equipment. The laundry machine represents a dynamic system; this results in a general re-distribution of the soil not held in dispersion over the surfaces of the fabric in the wash load.

In an effort to overcome wet-soil-redeposition, and especially wet-soil-redeposition on cotton fiber containing fabrics, the detergent industry has incorporated certain additives, such as for instance, sodium carboxymethyl cellulose. Redeposition of soil in the detergent process consists essentially of the deposition of dispersed particulate soil which may be considered to be in a colloidal state onto a fabric in a detergent liquor. Colloidal properties arise from a large value for the ratio of surface area to mass, although this does not, of course, extend to molecular dimensions. Therefore, it is reasonable to consider that the fabric with its very irregular surface and consequently large surface area, should also exhibit colloidal behavior in a detergent bath. On the basis of the above assumption, soil redeposition may be considered as being equivalent to the coagulation of the colloidal dispersion and the colloidal stability therefore should be applicable. The system consisting of dispersed soil and fabric detergent liquor may be treated as a colloidal system. Colloid stability or soil redeposition is governed by the result of three component forces: (1) an electrical force which may be either attractive or repulsive and that is due to a double layer interaction; (2) an attractive force that arises from the dispersion forces, and (3) a non-electrical repulsive force that is due to a non-electrical interaction of the surface adsorption layers of the particles. The ionogenic whiteness retention additives such as the sodium salt of carboxymethyl cellulose functions primarily by increasing the electrical repulsive force as a result of being adsorbed on soil and/or fabric. Carboxymethyl cellulose however, has not been proved to be suitable for incorporation into heavy duty liquid detergent mixtures, nor has carboxymethyl cellulose completely solved the soil redeposition problem in polyester fiber containing fabrics.

It is therefore an object of this invention to provide a soil-redeposition inhibitor which is superior to carboxymethyl cellulose.

[Price 25p]

It is a further object of this invention to provide a soil-redeposition inhibitor which provides improved laundering for polyester fiber containing fabrics.

It is an additional object of this invention to provide a soil-redeposition inhibitor which is suitable for incorporation into heavy-duty liquid detergents.

In accordance with this invention, it has now been discovered that hydroxypropyl methyl cellulose will serve as an effective soil-redeposition inhibitor, as well as a soil release agent when present in small quantities in a laundering bath. Preferably, the hydroxypropyl methyl cellulose is present in quantities of from 0.0001% to 0.5% based on the total weight of the bath. It should be understood that the hydroxypropyl methyl cellulose may also be present in soap and detergent compositions. When present in soap and detergent compositions, the hydroxypropyl methyl cellulose should be present in quantities of from 0.01% by weight to 5% by weight.

While the exact reasons for the improvement obtained from the use of hydroxypropyl methyl cellulose over the use of carboxy methyl cellulose are not known, it is known that carboxy methyl celluose is an ionic compound while the hydroxypropyl methyl cellulose is a non-ionic compound. It is also known that hydroxypropyl methyl cellulose exhibits inverse solubility; that is to say, it is more soluble in cold, than in hot water. This inverse solubility characteristic of hydroxypropyl methyl cellulose may cause it to precipitate out under hot laundry wash conditions, and deposit a hydrophilic coating or film on the surface of fabrics.

The hydroxypropylmethylcellulose used in the present invention can be any of the commercially available hydroxypropyl methyl celluloses, for example those which are commercially available under the trade names "Methofas," "Methocel" and "Celacol" (these being registered trade marks). Particularly convenient compounds are those having viscosities in the region of 15 cps — 12000 cps (these being determined as a 2% solution in water at 20°C). The average degree of substitution in respect of each of the methyl and hydroxypropyl groups being at most two, and the total degree of substitution being at most three per anhydroglucose unit.

The hydroxypropyl methyl celluloses may be prepared by swelling cotton linters or wood pulp with a sodium hydroxide solution to produce alkali cellulose which is treated with methyl chloride and propylene oxide yielding cellulose ethers with varying ratios of propylene glycol ether substitution to methoxyl substitution on the anhydroglucose units.

A better understanding of the invention may be had from the following specific example wherein comparative tests are made with various soiling and laundry baths both with and without the novel laundry aid of this invention. In general, the evaluations were conducted employing a bath comprising cotton, or a synthetic fibre fabric, a standard sludge soil of oil, clay, detergent, and water. Agitation of the bath was conducted in a Launder-Ometer (manufactured by Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago 13, I11.) at 60°C for thirty minutes. A soiling solution is prepared using 16 grams of a stock soiling mixture that has been shaken well. This mixture is diluted to one liter with hot tap water and stirred vigorously. Two hundred milliliters of the soiling solution are then added to a 3-1/2" × 8" Launder-Ometer can containing 10 steel balls. Sample swatches, prewet with water are then placed in each of the cans, sealed and rotated in the pre-heated Launder-Ometer for thirty minutes. Swatches are then removed and rinsed in cool tap water. The swatches are then machine washed while wet with 50 milliliters of a 0.001% aqueous solution of Tide (a detergent manufactured by Procter & Gamble Distributing Co., which consists essentially of the sodium salt of a sulphated lauryl alcohol, sodium sulphate and tetra sodium pyrophosphate) using a cold-wash, cold-rinse cycle and a low water level. The swatches are then tumble dried at approximately 160°F. Evaluation of the soil sample against the original sample is then made. The results of such testing procedures are given in the following table, identified as Table I.

TABLE I

0.3% (by weight on vol. of bath)	PET*	PET*/Cotton No Resin	PET*/Cotton with Resin	Cotton	Nylon	Triacetate	Acrylic
Hydroxy-propyl methyl cellulose	white	white	white	cream	white	cream	white
"Tide"	brown	brown	brown	cream	cream	lightly soiled	cream
Ethyl hydroxy ethyl cellulose	brown	brown	brown	lightly soiled	brown	light brown	brown
Polyethylene glycol molecular weight 4000	brown	brown	brown	lightly soiled	brown	light brown	brown
Sodium carboxy methyl cellulose	brown	brown	brown	white	brown	soiled	lightly soiled
Control (No additive)	brown	brown	brown	lightly soiled	brown	light brown	brown
	white > cream > lightly soiled > light brown > brown						
	cleanest ——————————————————————> dirtiest						

*Polyethylene terephthalate.

As can be noted from the results set forth in Table I, hydroxypropyl methyl cellulose produces superior whiteness in the laundered product than any of the comparative additives for control or control detergent. While Table I is an evaluation of hydroxypropyl methyl cellulose added directly to a soiling bath, it should be understood that hydroxypropyl methyl cellulose may also be incorporated into detergent compositions, or added directly to a laundering bath (Example). When incorporated into detergent compositions, the hydroxypropyl methyl cellulose is preferably present in quantities of from 0.01% by weight to 5% by weight. The following specific example of detergent compositions is given for purposes of illustration and should not be considered as limiting the scope of this invention.

Example

In one washing machine, a 4" × 4" swatch (Swatch A) of clean, 100% polyester tricot fabric was washed using 30 ml. of a 0.001% aqueous solution of "Tide" and 0.3 grams of hydroxypropyl methyl cellulose (4000 cps.). In another machine an identical swatch (Swatch B) was washed with 30 ml. of a 0.001%

aqueous solution of Tide, but in the absence of hydroxypropyl methyl cellulose. Both washings were done with a hot wash/warm rinse cycle. After the washing, the swatches were dried in a drier. The two samples were then subjected to a soiling test and a staining test.

In the soiling test, the swatches were added to a water dispersion of heavy oil, clay, and detergent in a can and rotated in a Launder-Ometer for 30 minutes at 60°C. At the end of this time, the swatches were removed from the can, rinsed under warm water, and then washed in a washing machine with a four-pound dummy load, 50 ml. of a 0.001% aqueous solution of Tide, and a warm wash, warm cycle. Swatch A, originally washed in the presence of hydroxypropylmethyl cellulose, was significantly cleaner than swatch B.

In the staining experiment, four drops of an oily/particulate (graphite) stain were spotted on to swatches A and B, and allowed to soak in for four hours. At the end of this time, the swatches were machine washed using 50 ml. of a 0.001 aqueous solution of Tide a four-pound dummy load and a hot wash/warm rinse cycle, and then dried. Swatch A showed considerably less stain than did swatch B.

As previously mentioned, the hydroxypropyl methyl cellulose need not be added directly to the laundry bath but may be incorporated in laundering soaps and detergent compositions so as to form substantially homogeneous mixtures.

Detergent compositions suitable for use in conjunction with hydroxypropyl methyl cellulose are any of the well-known detergent compositions such as for instance, those comprising a surface-active agent possessing good detergent properties, an alkali salt of a weak inorganic acid, a neutral inorganic salt, and optionally a deflocculating agent. Suitable alkali salts of weak inorganic acids are water-soluble phosphate salts including sodium tripolyphosphate, tetrasodiumpyrophosphate, trisodium-orthophosphate and sodium hexametaphosphate. In preparing heavy-duty detergent compositions it is preferred to use a substantial portion of sodium tripolyphosphate. Alkali metal silicates are also effective building materials in detergent compositions. Suitable compounds within this category include sodium silicate and sodium metasilicate pentahydrate. Sodium salts of strong inorganic acids are also important building materials for the detergent compositions for use herein. Such salts do not hydrolyze, but disassociate to a sufficient extent to provide sodium ion in the detergent solution. A small quantity of an alkali metal carbonate, such as sodium carbonate, is also desirable. As surface active agents generally possess a propensity to deflocculate, satisfactory detergent compositions may often be obtained with or without deflocculating agents. The surface active agent or surfactant may be a surfactant such as for instance, alkyl aryl sulfonates, alkyl sulfates, including surfactants with both branched-chain and straight-chain alkyl groups, as well as primary and secondary sulfate groups. Sulfates and sulfonates containing an intermediate linkage between the hydrophobic and hydrophillic groups such as the fatty acylated methyl taurides and the sulfated fatty mono-glycerides, long-chain acid esters of polyethylene glycol, polyethylene glycol ethers of alkyl phenols, polyethylene glycol ethers of long-chain alcohols and mercaptans, fatty acyl diethanolamides, block co-polymers of ethylene oxide and propylene oxide.

Soaps which are suitable for use in conjunction with the laundry aids of this invention are sodium or potassium salts of fatty acids. These soaps are commonly in the form of cakes, powders, granules and flakes, and are relatively high in free alkali. These compounds normally contain builders which aid in detergency. The builders may be such ingredients as sodium carbonate, sodium silicate, and tetrasodium pyrophosphate.

British Specification No. 989683 describes and claims a water-soluble detergent briquette which is resistant to abrasion and accidental breakage, when dry, and disintegrates readily in water, comprising a multiplicity of solid particles composed of a homogeneous mixture of water-soluble non-ionic organic detergent and water-soluble inorganic builder salt, of 16 to 25% moisture content, in the form of adhering particles coated with 3 to 20% water-soluble silicate, the coated particles being lightly compacted and fused together to form a shaped briquette, which is coated with an adhering and binding film of 0.25 to 5% of a readily water-soluble organic film-forming polymer. The Specification discloses that hydroxypropyl methyl cellulose is a water-soluble organic film-forming polymer which can be used for the bonding film of the briquette although it is preferably used for this purpose in conjunction with polyvinyl alcohol.

WHAT WE CLAIM IS:—

1. A method for preventing wet-soil redeposition and improving stain release on laundered fabrics, the method comprising adding to the laundry bath, prior to the start of the laundering cycle, a minor amount of hydroxypropyl methyl cellulose.

2. A method as claimed in claim 1, wherein the hydroxypropyl methyl cellulose is present in quantities of from about 0.0001% to 0.5% by weight based on the total weight of the laundry bath.

3. A method as claimed in claim 1 or claim 2, wherein the fabric is a polyester fibre-containing fabric.

4. A method according to claim 1 substantially as hereinbefore described with reference to the foregoing Example.

5. A detergent composition for use in the laundering of fabrics according to the method claimed in any one of claims 1 to 4, compris-

ing a substantially homogeneous mixture of a surface-active detergent agent, an alkali salt of a weak inorganic acid, a neutral inorganic salt and hydroxypropyl methyl cellulose.

6. A composition as claimed in claim 5, wherein the hydroxypropyl methyl cellulose is present in quantities of from 0.01% to 5% by weight.

7. A composition as claimed in claim 5 or claim 6, wherein the alkali salt of a weak inorganic acid is sodium tripolyphosphate.

8. A soap composition for use in the laundering of fabrics according to the method claimed in any one of claims 1 to 4, comprising a sodium or potassium salt of a fatty acid and hydroxypropyl methyl cellulose.

9. A soap composition as claimed in claim 8, wherein the hydroxypropyl methyl cellulose is present in quantities of from 0.01% to 5% by weight.

D. J. C. WOOD,
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1973.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.